STATEMENT OF WORK
Systems Development, Support and Integration
(Software Definable/Reconfigurable Systems (SDS) Design)

1.0 BACKGROUND

1.1 Introduction

The Naval Center for Space Technology (NCST), an organization within the U.S. Naval Research Laboratory (NRL) in Washington, DC, is the designated lead for Navy Space Programs. NCST has the mission to preserve and enhance a strong space technology base and provide expert capabilities in the development and acquisition of space, aerospace and Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) systems which support Naval Missions.

In support of this mission, the Space Systems Development Department (SSDD), a department within NCST, has the primary responsibility to develop space, aerospace and C4ISR systems, and to evolve the emerging technologies that advance the capabilities of these systems to perform science and operational missions. The SSDD develops and advances technologies, defines mission needs, defines concepts of operations and system requirements based on mission needs, develops system architectures, designs and develops systems and subsystems, demonstrates their capabilities and transitions these systems to operational use. SSDD presently has programs at various stages of development and transition. In addition, SSDD is currently involved in the concept definition and design phases on various advanced concepts studies and projects which will evolve into future space, aerospace and tactical C4ISR systems.

1.2 Objective

The objective of this Statement of Work (SOW) is to define the Systems Development, Support and Integration (SDSI) Software Definable/Reconfigurable Systems (SDS) Design tasking required in support of the SSDD technology advancements, systems requirements definition, architectures development, and the systems and units design, development and transition to operational use.

1.3 Scope of Work

The scope of this statement of work includes required support in the areas of (1) Contract Phase-in, (2) Program Management, (3) Documentation, (4) Systems Engineering, (5) Systems Design and Development, (6) Systems Effectiveness, (7) Parts Procurement and Processing, (8) Fabrication and (9) Test and Verification

The SDSI Contractor shall provide all personnel, resources and materials necessary to provide the support required. The Contractor shall not incorporate proprietary hardware or software in any deliverable developed under this contract unless authorized, in writing, by the Contracting Officer. Some of the tasking under the effort will be required to be performed at the Sensitive Compartmented Information (SCI) Level. The attached Personnel Qualifications and DD254 provides specific requirements.

2.0 APPLICABLE DOCUMENTS

The Contractor shall comply with the following specifications, standards, and publications as they apply to each task. Where specified, the exact revision level of the reference listed shall be used. Where a revision level is not included, the latest reference to the document from the Department of Defense Index of Specifications and Standards (DODISS) shall apply. Nothing in this document, however, supersedes applicable laws or regulations unless a specific exemption has been obtained. In the event of conflict between the referenced documents and this SOW, the requirements of this SOW shall apply.

2.1 SSDD Technical Specifications and Documents

Document Number	Description
SSD-D-005J	Configuration Management Plan
SSD-D-009C	Destructive Physical Analysis Procedure
SSD-D-010	Engineering Design Handbook for Spacecraft Electronic and Electromechanical Parts
SSD-D-059	NRL/SSDD Monthly Status Report Procedure
SSD-D-061	Procedure for the Preparation of Program Plans
SSD-D-072B	Naval Center for Space Technology Document Style Guide
SSD-D-AS139	Qualified Parts List
SSD-D-AS142	Software Development Specifications
SSD-D-AS210C	Worst Case Analysis Guidelines and Criteria
SSD-D-AS214	Parts Program Requirements and Guidelines
SSD-D-AS303	Quality Assurance Program Requirements and Guidelines
SSD-D-AS322	Test Methods and Controls
STC-D-001	Spacecraft Product Assurance Program Plan
STC-D-002	Naval Center for Space Technology (NCST) Parts Program Requirements and Guidelines
STC-D-010	Preferred Parts List
5100.13C	NRL Occupational Safety and Health Manual
5510.40D	NRL Security Manual

The above documents will be available for viewing on line at the NRL Contract Web Site or

in the Contracting Office, Code 3200, Naval Research Laboratory, 4555 Overlook Ave, SW, Washington, DC 20375-5326. After contract award the documents can be obtained from the designated Contracting Officer's Representative (COR).

2.2 Military/Department of Defense Specifications and Standards

Document Number	Description
DOD-E-8983C	Electronic Equipment, Aerospace, Extended Space Environment, General Specification for
DOD-HDBK-263b	Electrostatic Discharge Control Handbook for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices) (Metric)
MIL-HDBK-217F(2)	Reliability Prediction of Electronic Equipment
MIL-HDBK-454(1)	General Guidelines for Electronic Equipment
MIL-PRF-31032	Specification Printed Circuit Board/Printed Wiring Board, General Specification for
MIL-PRF-123	Capacitors, Fixed, Ceramic Dielectric (Temperature Stable and General Purpose), High Reliability, General Specification for
MIL-PRF-55365	Capacitor, Fixed, Electrolytic (Tantalum), Chip, Non-established Reliability, Established Reliability, General Specification For
MIL-STD-461E	Requirements for The Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
MIL-STD-881	Work Breakdown Structures for Defense Material Items
MIL-STD-981	Design, Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Applications
MIL-STD-1540D	Product Verification Requirements for Launch, Upper Stage, and Space Vehicles
MIL-T-31000	General Specification for Technical Data Packages

Description	Version
NRL Occupational Safety and Health Manual,	5100.13C
NRL Security Manual	Manual, 5510.40D

Description	Version
JTRS Software Communications Architecture Specification	Version 2.2.2, 15 May 2006

JTRS Software Communications Architecture Extensions	Version 2.2.2, 22 December 2006
JPEO JTRS Standards Standardization Plan	Version 1.8, 30 April 2008
JPEO JTRS Software Standards	Version 1.2.2, 01 October 2007
JTRS Unified INFOSEC Criteria	Revision 2, 02 December 2005 (SECRET//NOFORN)

Document Number	Description
NASA-STD-8739-1	Workmanship Standard For Staking And Conformal Coating of Wiring Boards and Electronics Assemblies
NASA-STD-8739.2	Workmanship Standard for Surface Mount Technology
NASA-STD-8739.3	Soldered Electrical Connections
NASA-STD-8739.4	Crimping, Interconnection Cables, Harnesses and Wiring
NASA EEE-INST-002	Instructions for EEE Parts Selection, Screening Qualification and Derating

2.3 Non-Government Documents

2.3.1 American National Standards Institute (ANSI)/Electronic Industries Association (EIA)

Document Number	Description
ANSI/EIA Standard 748-98	Earned Value Management Systems
EIA/IS-649	Configuration Management
EIA/IS-632	Systems Engineering

(Applications for copies should be addressed to the American Nation Standard Institute, 1430 Broadway, New York, NY 10018.) and/or (Application for copies should be addressed to Electronic Industries Association, 2001 Pennsylvania Ave., NW, Washington, DC 20006.)

2.3.3 Institute of Electrical and Electronic Engineers (IEEE)

Document Number	Description
IEEE/EIA 12207.0,	Standard for Information Technology – Software life cycle processes March 1998
IEEE/EIA 12207.2,	Standard for Information Technology – Software life cycle processes – Implementation considerations April 1998

(Applications for copies should be addressed to the Institute of Electrical and Electronic Engineers Inc., 345 East 47th Street, New York, NY 10017. Online IEEE standards may be obtained at http://standards.ieee.org/catalog/olis/index.html.)

2.3.4 International Organization for Standardization (ISO) Standards

Document Number	Description
AS9100, Rev B	Aerospace Quality Management Systems
ISO 9001:2000	Quality Management Systems – Requirements

3.0 MANAGEMENT REQUIREMENTS

The Contractor shall accomplish this tasking using the requirements in this contract, supplemented by the supporting documents referenced in Section 2.0, entitled Applicable Documents.

3.1 Contract Phase-In

The SDSI Contractor shall integrate its organization into the ongoing system development effort being performed by the incumbent Contractor within sixty (60) days after the effective date of the contract, or the date of contract award, whichever is later.

The Contractor's Program Manager shall be responsible for scheduling, coordinating, and executing any necessary transition activities and immediately notifying the COR if issues arise precluding effective transitioning.

3.2 Program Management

The Contractor shall provide the program management, control, and reporting functions necessary to manage and direct the accomplishment of the efforts required under this SOW. The Contractor's management, design, development, production, test and quality assurance systems shall be certified to AS9100 Rev. B, Aerospace Quality Management Systems, and ISO 9001:2000, Quality Management Systems Requirements.

3.2.1 Program Manager

The Contractor shall designate a Program Manager (PM) who shall have responsibility for the SDSI Programs, and act as the primary technical point of contact with NRL for all matters pertaining to this contract. The Program Manager shall keep the COR informed of the status of the technical and management efforts and expenditures on the contract by means of written

monthly reports, in accordance with CRDL A001, by telephone conversations, and by meetings at the Contractor's facility and at NRL

3.2.2 Program Control

The Contractor shall establish and maintain a management system for control and reporting of the program and contract efforts, including cost, schedule, and technical performance, for the life of the contract. The management system shall provide the Contractor with the ability to access technical achievement, to measure progress and to determine and accrue costs accurately for all activities under the contract.

3.2.2.1 Contract Work Breakdown Structure.

The Contractor shall implement a management system structured using a Contract Work Breakdown Structure (CWBS), compliant with MIL-STD-881 and approved by the COR in accordance with CDRL A011. A direct correlation shall exist between the CWBS developed by the Contractor and the WBS employed by the SSDD for its control and reporting purposes. Revisions to the CWBS and the attendant CWBS Dictionary shall be submitted in accordance with DD Form 1423 - Contract Data Requirements List (CDRL), CDRL A001 (C), entitled Contract Work Breakdown Structure.

3.2.2.2 Program Technical, Cost and Schedule Control

The Contractor shall maintain program technical, cost and schedule control of all activities under the contract. On significant tasking and/or programs, when directed by the COR, the Contractor shall implement a formal Earned Value Measurement System (EVMS) that fully complies with the EVMS guidelines of ANSI/EIA Standard 748-98, Earned Value Management Systems. The Contractor shall employ this EVMS to measure the actual cost and schedule of accomplishments and compare these to the planned cost and schedule baseline to determine variances in cost and schedule from the established baseline. The Contractor shall employ these measurements to evaluate and report earned value and variances, and to enact/recommend measures to resolve any significant variances. The Contractor shall submit a monthly EVMS Report in accordance with Contract Data Requirements List (CDRL) Item A001 (B) on those programs directed by the COR.

On significant tasking and/or programs, when directed by the COR, the Contractor shall also implement a formal risk management system (RMS), with which the Contractor shall continually assess technical, cost and schedule risk and implement/recommend and report on measures planned and implemented to mitigate high and medium risks.

3.2.2.3 Project Plans/Schedules

The Contractor shall generate and maintain schedules for each task assignment in both GANTT and PERT format, or other appropriately designated scheduling format. The Contractor shall ensure that adequate resources are assigned to the tasks to be accomplished, and shall report on any deficiencies. These schedules shall be submitted under CDRL Item A002, Program Schedules.

The Contractor shall also generate, update and maintain program schedules for ongoing SSDD space/aerospace systems development programs in accordance with CDRL A002, Program Schedules. This task shall include the integration of all subsystem schedules into a master program schedule, and verification of schedule compatibility with the master development schedule. The program schedules shall consist of a master schedule, separate subsystem schedules, and a test and integration schedule for use by the SSDD. The schedules shall be prepared using both Gantt and PERT formats. The Contractor shall revise and submit schedules on a quarterly basis. More frequent submissions may be required by the COR if the program progress or risk dictates.

3.2.3 Monthly Status Reporting

The Contractor shall provide SSDD with a Monthly Status Report (MSR) in accordance with SSD-D-059, Monthly Status Report Procedure and CDRL A001. The following paragraphs define the information that the Contractor shall include in the MSR. The MSR shall be submitted under CDRL Item A001 (A). The Contractor shall schedule a MSR Meeting with the COR to go over the contents of the MSR.

On tasking and/or programs in which the Contractor implements a formal risk management system (RMS), the Contractor shall report the results and status of these systems in the MSR, including the risk assessment results and the recommended and/or implemented mitigation measures.

The Contractor shall provide highlights of actions that occurred during the reporting period relative to contract performance. Significant actions include any that will impact, or have impacted, the projected performance, cost or schedule of the SDSI Contract efforts.

The Contractor shall provide information on deliveries, meetings and on schedules versus actual work performed. Actual and projected slippages and ahead of schedule accomplishments shall be reported along with their actual and projected impact on overall contract performance.

The Contractor shall report on the status of all materials, Government Furnished Equipment (GFE), data items and travel. The Contractor shall include an update of any previously reported unresolved issues. The Contractor shall maintain an accurate inventory of all GFE in accordance with the Federal Acquisition Regulation Part 45.. A complete listing describing all GFE and its location shall be prepared and made available to the COR on an as needed basis.

The Contractor shall also provide a monthly total of all on-site/off-site labor hours (which shall include subcontractor labor hours) broken down by task assignment.

3.2.4 Financial Reporting

The contract financial status shall be reported monthly in accordance with Department of Defense (DoD) Data Item Description (DID), DI-F-6010A, Cost/Schedule Status Report (C/SSR), tailored to the SSDD requirements to include current month, as well as cumulative month cost data in accordance with CDRL A001. The cost data shall be correlated to the CWBS elements. A narrative explanation shall accompany the charts. The Contractor shall provide SSDD with a Contract Funding Status Report (CFSR) monthly with the C/SSR. The C/SSR and CFSR shall be submitted as part of the Monthly Status Report.. The Contractor shall also provide more detailed financial and staffing level information on individual tasks and programs when requested by the COR.

3.2.6 Security and Safety Compliance

The Contractor shall comply with the NRL Occupational Safety and Health Manual, 5100.13C, and the NRL Security Manual, 5510.40D with respect to all Contractor employees located at NRL. The Contractor shall assist SSDD in its on-going safety program, which entails taking a proactive approach towards providing a safe and healthy workplace. The Contractor shall provide expertise and support with respect to: compliance with Government safety provisions, on-site identification and elimination of safety and environmental hazards, facilitating the correction of safety and environmental deficiencies reported by building monitors and/or identified during the annual NRL Safety and Environmental Inspection(s), and to otherwise provide supplementary safety training and educational support, as needed.

4.0 DOCUMENTATION REQUIREMENTS

The Contractor shall provide the personnel, equipment and facility necessary to perform the documentation efforts required includes support in the following areas: (a) generating and preparing program planning documents and briefings, (b) performing configuration management functions, (c) performing data management functions, (d) generating technical documentation, and (e) documentation review and evaluation.

The documentation provided under this task shall be compatible with Microsoft Office Products (Word, Excel, PowerPoint, Visio, and Project) and the Adobe Creative Suite 3 Products (Photoshop, Illustrator InDesign, Acrobat) All documentation developed under this contract shall be delivered specified in the CDRL and SHALL NOT contain any proprietary markings.

4.1 Program Plans and Briefings

The Contractor shall assist the COR in generating program plans and briefings on assigned programs.

(a) Program Planning Documents - The Contractor shall generate and update program plans in accordance with SSD-D-061. The Contractor shall also generate and provide updates to other SSDD planning documents which may include, but may not be limited to, program implementation, system development, and test plans for existing and new space/aerospace programs, in accordance with CDRL Item A003, Program Documentation.

(b) Program Briefings - The Contractor shall prepare program status and technical briefings for the SSDD in accordance with CDRL Item A003, Program Documentation.

4.2 Configuration Management

The Contractor shall maintain configuration control of both the classified and unclassified SSDD space/aerospace programs in accordance with EIA/IS-649, entitled Configuration Management. The work required includes under: (a) establishing hardware and software configuration items, (b) performing configuration change management, (c) performing configuration status accounting, (d) performing configuration audits and verification, and (e) performing CM planning and management.

4.3 Data Management

The Contractor shall ensure that deliverable data items are delivered in accordance with the schedule, that the items are tracked as they are being reviewed and that the proper approvals are received for each deliverable in accorandance with its applicable CDRL. The Contractor shall also employ an automated system to organize, catalog, distribute, control and store documents, drawings. As part of this effort, the Contractor shall provide status reports on drawings and conduct regular periodic inventories to ascertain item availability, legibility and reproducibility in accordance with CDRL A001. All files shall be backed up to ensure document retention in event of equipment failure.

4.4 Technical Documentation

The Contractor shall generate technical documentation for assigned required support which includes: (a) system development specifications, (b) interface control documents, (c) system schedules, (d) system test documentation, (e) subsystem/equipment type B2 specifications, (f) general subsystem development specification and contents, (g) subsystem software development specifications, and (h) other system technical documentation. All technical documentation shall be prepared in accordance with SSD-D-072, Naval Center for Space Technology Document Style Guide. This technical documentation shall be submitted in accordance with CDRL A004, Technical Documentation.

(a) System Development Specifications - The Contractor shall maintain and update the existing system development specifications for various SSDD space/aerospace development programs. These specifications define the system level performance requirements and verification methods. The Contractor shall revise these specifications to reflect requirements/verification changes as the systems evolve. All specification revisions shall be approved through the SSDD system design process.

(b) Interface Control Documents - The Contractor shall develop, update and maintain internal and external Interface Control Documents (ICD's) which specify interface requirements for SSDD space/aerospace systems. The required documents shall reflect the results of applicable design reviews. The Contractor shall also develop, update and maintain the Interface Wire Lists (IWL) for individual systems to enable integration and test planning and performance. The IWL's shall define the interconnections of subsystems/equipment with each other as well as with other systems. The IWL's shall be referenced to the ICD's to assure conformance with specification requirements.

(c) System Test Documentation - The Contractor shall develop, update and maintain the system test documentation required to implement approved program test plan requirements.

(d) Subsystem/Equipment Specifications - The Contractor shall update the existing subsystem/equipment specifications and prepare new subsystem/equipment specifications for spacecraft and aerospace Software Definable/Reconfigurable Systems equipment. During performance of the qualification phase design and development required support of each development program, the Contractor may be required to prepare additional lower level equipment specifications to properly identify and control equipment configuration and performance. The Contractor shall prepare these additional specifications in accordance with CDRL A003. The Contractor shall submit preliminary copies of each subsystem/equipment specification to SSDD for review and approval in accordance with the CDRL. The Contractor shall review the preliminary copies and submit final copies for COR approval. The Contractor shall update subsystem specifications after each system design review in accordance with CDRL A013.

(f) General Subsystem Development Specifications and Contents - The Contractor shall update and maintain the general specifications containing the common requirements to be used in each subsystem Type B2 specification. The Contractor shall use this document to assure that consistence or format and terminology is maintained throughout the specification generation and overall documentation effort.

(g) Subsystem Software Development Specifications - The Contractor shall update and maintain the existing subsystem software development specifications and generate new software development specifications based on program management requirements. Changes shall be incorporated through the specification change procedures defined in NRL Document SSD-D-AS142.

(h) Design Data - The Contractor shall prepare, update and maintain the design data for all designs developed under this SOW. This design data shall be submitted in accordance with CDRL Item A005, Design Data, and shall include:

(i) Technical Reports - which shall include, but may not be limited to, system analysis reports, system requirements allocation reports, system test reports, and document lists and similar.

(ii) Specification Trees - which shall include the preparation and maintenance of all specification trees related to the program documentation task.

(iii) Parts Lists - which shall include all system parts lists.

(iv) Design Review Reports - which shall include, but be limited to, system design review results, action item assignments, action item resolutions and First Article Configuration Inspection (FACI) results.

(v) Technical Data Packages - which shall include, but be limited to, drawings, procedures, materials and process documents, system drawings, and lists that define a specific system, subsystem or unit design. The Contractor shall generate and maintain a level two technical data package that completely describes the design as described in MIL-T-31000, General Specification for Technical Data packages.

(vi) Parts Program Documents - which shall be in accordance with SSD-D-AS214, Parts Programs Requirements and Guidelines and STC-D-002 “Naval Center for Space Technology (NCST) Parts Program Requirements and Guidelines”

(vii) Quality Assurance Documents - which shall be in accordance with SSD-D-AS303, Quality Assurance Programs Requirements and Guidelines.

(viii) Construction Documents - which shall be in accordance with SSDD manufacturing procedures.

(ix) Test Methods and Control Documents - which shall be in accordance with SSD-D-AS322 and SSD-D-072B “Naval Center for Space Technology Document Style Guide”

4.5 CAD/CAM Support

The Contractor shall employ computer-aided design and computer aided manufacturing (CAD/CAM) technologies, techniques, methods and systems in the design, design analysis, modeling and simulation in the development and documentation of space/aerospace system and units under this SOW.

The Contractor shall design and produce printed wiring board designs for high density, high reliability space and aerospace Software Definable/Reconfigurable systems, including high density flat pack, ball grid array and column grid array device package technologies, and those designs requiring impedance matching, thermal coefficient of expansion (CTE) matching and those designs with thermal/power dissipation design challenges. The resultant printed wiring boards shall be compliant with MIL-PRF-31032. The Contractor shall design and develop housings and detailed fabrication items for space and aerospace Software Definable/Reconfigurable Systems (SDS) featuring high density, small size and light weight. (CDRL)

4.6 Graphics and Illustrations

The Contractor shall prepare presentation-quality graphics and illustrations in black and white, as well as color, depicting satellites, antennas, ground stations, test equipment, and various other aspects of space and aerospace Software Definable/Reconfigurable System programs as required in support of requirements such as presentation of concepts, technical reports, and meetings, .

4.8 On-Line Resource Service

The Contractor shall design, develop host, and maintain websites for Software Definable/Reconfigurable Systems programs. These websites shall be password protected, and provide pertinent program documentation, schedules, calendar of events, and other related information for access and downloading by approved program personnel.

4.9 Documentation Review and Evaluation

The Contractor shall participate in requirements and design reviews and technical interchange meetings planned for each development program. The Contractor shall critique the design documentation for completeness and compatibility with SSDD-established documentation requirements, and shall present the results of these critiques to the COR in accordance with CDRL A013.

The Contractor shall review documentation generated by SSDD and other participating Contractors, evaluate its compliance with the established SSDD criteria, and assess its impact on the content of the design specifications and other system and subsystem technical documentation. The Contractor shall inform SSDD via CDRL A018 of its assessment of the impact and recommend changes to the program documentation. Documentation to be reviewed shall minimally include: technical reports, schedules, analysis reports, design specifications, briefings, design review data packages, drawing packages, design review minutes and action item responses, test plans and procedures, test reports and similar.

5.0 ENGINEERING REQUIREMENTS

5.1 Systems Engineering

The Contractor shall analyze SSDD Software Definable/Reconfigurable Systems (SDS) systems, perform evaluations of systems interfaces, participate in system definition and development, and generate metrics and measures of effectiveness for each system in accordance with EIA/IS-632, Systems Engineering. The Contractors systems engineering team shall plan, coordinate, and integrate systems engineering, design analysis, risk mitigation, and other engineering related efforts as required and directed by the COR.

5.1.1 System Definition

The Contractor shall identify and characterize (in terms of performance, weight,internal/external interfaces, specifications, etc.) any element of and/or all major components of a system design. This shall include key specifications defining modes, capabilities and interfaces. Specifically, this shall include mechanical structures command and control, experiments, electrical power generation/distribution, data handling and distribution, communications, ground/space component distribution, orbital visualization and other system related components. This shall be accomplished using an explicit, documented evaluation of the tradeoffs among alternatives involving the degree of assurance of achieving all program objectives (including performance and reliability/lifetime) and system acquisition cost.

5.1.2 System Analyses and Planning

The Contractor shall analyze current and planned system architectural concepts, plans, implementations, and operational analyses. Any potential areas for improvement shall be identified. The Contractor shall also identify technologies that should be pursued to improve the system architectures. The Contractor shall assist in the development and maintenance of applicable concept plans, white papers, Concept of Operations (CONOPS) and standard operating procedures. The results of these system analysis and planning efforts shall be reported under CDRL Item A004.

5.1.3 Technical Assessments

The Contractor shall prepare technical assessments and engineering analyses to identify, recommend, and implement resolutions of critical design or performance deficiencies. The Contractor shall provide system level integration test plans and procedures; identify and report deficiencies; support design reviews; identify, analyze or develop decision support, simulation or modeling support activities; and provide short-term engineering analyses and quick reaction studies. The Contractor shall also assist in system survivability analyses and in analyzing and resolving protocol issues. These analyses shall be submitted under CDRL Item A004.

5.1.4 Independent Verification and Validation (IV&V)

The Contractor shall participate in the Independent Verification and Validation (IV&V) system support of SSDD system hardware and software. The IV&V efforts will ensure that the requirements levied on the system have been fully satisfied by the design and that no additional functionality has crept into the system. The IV&V effort will focus on all areas of the design, including: requirements traceability, maintainability, testability, interface analysis, stress testing, software design and software process Additionally, the IV&V efforts will validate system and subsystem performance and functionality. The results of these IV&V efforts shall be documented and submitted under the CDRL Item A004.

5.1.5 Technical Reviews

The Contractor shall be responsible for conducting all the technical reviews and audits for the efforts described within this contract. The specific reviews that will occur in any given program or project will vary. A representative sample of typical reviews includes:

- Systems Requirements Review (SRR)
- System Design Review (SDR)
- Software Specification Review (SSR)
- Preliminary Design Review (PDR)
- Critical Design Review (CDR)
- Technical Interchange Meetings (TIMs).

The Contractor shall video selected reviews and submit the video under CDRL Item A004.

5.1.6 Systems Engineering Support To Integration and Test

The Contractor shall have the demonstrated capability to and shall provide systems engineering support to integration and test programs for SSDD. This systems engineering support shall provide systems engineering support to requirements and verification method definition, integration and test concepts, approaches and architectures, integration and test systems software technologies selection and integration and test programs implementation.

5.1.7 Systems Application Engineering

The Contractor shall have the demonstrated capability to and shall perform systems applications engineering efforts for existing and advanced Software Definable/Reconfigurable Systems (SDS). Engineering efforts to be performed under this subtask shall include, but may not be limited to analyzing, defining, developing, evaluating, and controlling (a) bus architectures, their protocols and throughput characteristics, (b) subsystem design implementations, (c) fail-

safe/fault-tolerant provisions, (d) modeling and simulation of system performance using MATLAB and SIMULINK, (e) functional interfaces among subsystems.

Deliverables under this subtask shall include formal reports in the form of design packages which shall be submitted in accordance with CDRL Item A005.

5.1.8 Performance Analysis

The Contractor shall conduct performance analyses as well as troubleshooting and data analysis for both space and aerospace Software Definable/Reconfigurable systems and subsystems. Analysis of performance may include pre-operational, operational, and post-operational mission phases. The work to be performed under this subtask shall include, but may not be limited to, (a) analysis of mission data to determine subsystem and system performance characteristics, (b) recovery, reduction and analysis of mission data, (c) development of systems necessary for collection, reduction and analysis of mission data, (d) provision of real-time problem analysis and resolution for operational missions, (e) analysis of mission data to determine the nature of faults or performance-limiting factors, and (f) development of solutions, including flight software to maximize mission performance.

5.2 Systems Design and Development

The Contractor shall have the demonstrated capability to and shall design, develop, and fabricate selected proof-of-concept, engineering models, and operational systems for NRL systems development support. . The engineering expertise required to accomplish this development shall be from employees of the Contractor unless otherwise approved by the COR Software Defined/ Reconfigurable Systems, Radios and Payloads (SDS's, including SDR's, SRP's, SRR's), SDS Applications and Infrastructure Software and Firmware, Tactical Internet Controller Systems, In addition, the Contractor shall accomplish the modeling and simulation necessary to verify the maturity and performance margins of the system designs. All systems development efforts shall be performed in accordance with SSDD document STC-D-001, shall be guided by DOD-E-8983C, DOD-HDBK-263 and MIL-HDBK-454(1), and as specified herein.

5.2.2 Software Definable/Reconfigurable Systems (SDS) Design and Development

The Contractor shall have the demonstrated capability to and shall design, develop, manufacture and test software reconfigurable systems (SDS's) capable of simultaneously providing multiple communications channels, communications and data routing, data exploitation, blue force tracking and SIGINT intelligence data gathering and processing. Essential to this tasking shall be the capability to develop JTRS SCA v2.2.2 compliant hardware and software infrastructures and core frameworks, advanced, high speed, low power, distributed, FPGA based processing engines, advanced, efficient, low power RF filters, FPGA based digital signal filters, JTRS compatible POSIX operating environments and object oriented CORBA components. Recent

and current NRL SDS Programs include the Software Reconfigurable Payload (SRP) and the Operationally Responsive Space (ORS) Technology Demonstrator (ORSTech). These programs represent a core technology for the creation of radio transceivers/software defined payloads that are smaller, lighter and more flexible tactical systems.

The Contractor shall also have the demonstrated capability to and shall provide waveform and software applications development to support the reprogramming of the payloads for new missions as required by NRL.

The Contractor shall have the demonstrated capability to and shall develop software reconfigurable radios that may run from 16Kbps to 300Mbps using uploaded FPGA and GPP code. The Contractor shall have the demonstrated capability to and shall process higher speed waveforms using multiple FPGA based distributed mesh processing architecture with waveform components distributed among multiple FPGAs.

5.2.3 SDS Applications and Infrastructure Software and Firmware Design, Development And Porting

The Contractor shall have the demonstrated capability to provide JTRS Software Communications Architecture (SCA) v2.2.2 compatible applications design, development and porting, with emphasis on the JTRS SINCGARS Communications Waveform, the SoftINC tactical internet controller, communications routing, broadcasting, and SIGINT applications. The Contractor shall include structured software engineering and program management processes compliant with IEEE/EIA 12207.0 and IEEE/EIA 12207.2. The Contractor shall ensure that all applications comply with the JTRS Application Programming Interfaces (APIs) and Software Defined Radio (SDR) Standards including the JTRS Software Communications Architecture (SCA) as specified in the JTRS Software Communications Architecture Specification, Version 2.2.2, the SCA Extensions Specification and the JPEO JTRS Software Standards, Version 1.8. In addition, the Contractor shall ensure all INFOSEC related applications adhere to JTRS Unified INFOSEC Criteria (UIC) Specification, Revision 2.

The Contractor shall have the demonstrated capability to and shall provide portable, JTRS compliant Operating Environments (OE) and Waveform Development Environments for use in the development of SDS waveforms and applications.

The Contractor shall have the demonstrated capability to and shall provide an automated metric collection system to collect the following metrics at both the unit- (CSU) and product- (CSCI) levels: Logical Source Lines Of Code (LSLOCs), non-volatile footprint (ROM), run-time footprint (RAM), SCA AEP violations, cyclomatic complexity, unreachable code, unused variables, comment-to-code ratio, and UIC compliance.

5.2.4 Tactical Internet Controller Systems Design And Development

The Contractor shall have the demonstrated capability to and shall provide a Software Communications Architecture (SCA) v2.2.2 compliant Enterprise Network Services Software Internet Controller (SoftINC) using an object oriented, CORBA component architecture and MIL-STD-188-220C interfaces.

6.0 SYSTEMS EFFECTIVENESS

The Contractor shall have the demonstrated capability to and shall provide the necessary resources to perform the following systems effectiveness efforts:

6.1 Reliability, Maintainability and Availability Engineering

The Contractor shall evaluate the inherent and achieved reliability, maintainability and availability (RMA) characteristics of the various Software Definable/Reconfigurable Systems (SDS) developed by the SSDD. The Contractor shall evaluate overall system RMA potential, compare this potential to the RMA requirements, and recommend RMA enhancement efforts where applicable. The Contractor shall also conduct RMA trade-offs among competing design concepts. The required analyses shall be performed in accordance with established SSDD procedures. The Contractor shall provide briefings, results summaries and detailed analysis reports documenting the analysis results on an interim and final basis with identification of unresolved design issues and the schedule for analyses yet to be performed. The analysis reports shall be submitted in accordance with CDRL A006, RMA Analysis Reports. Where previous analysis reports exist, the Contractor shall revise and refine the previous reports when directed by the COR.

6.1.1 Subsystem And Unit Reliability Engineering

The Contractor shall conduct reliability engineering analyses of the SSDD subsystem and unit designs in accordance with STC-D-001. The reliability analyses to be performed shall include, but may not be limited to (a) Failure Modes, Effects and Criticality Analyses; (b) Electrical Stress Analyses; (c) Reliability Models and Predictions; and (d) Failure Rate Calculations. The Contractor shall identify areas where subsystem reliability may be improved and provide a description of the means available to achieve this improvement. The results of 6these analyses shall be documented in formal reports and shall be submitted under CDRL A006.

6.1.1.1 Subsystem Failure Mode, Effects and Criticality Analyses (FMECA)

The Contractor shall prepare subsystem FMECA's to identify potential failure modes and evaluate their effect on the operation of the subsystem. The Contractor shall verify redundancy implementations, identify any single point failure modes and prepare design modification recommendations that would lessen the impact of failure occurrence on subsystem operation. The criticality of each failure mode shall be derived to provide a quantitative means of

evaluation. The Contractor shall also modify these analyses to reflect data collected as a result of testing. The Contractor shall assure that subsystem level FMECA's are capable of integration into the system level FMECA with minimal effort.

6.1.1.2 Electrical Stress Analyses

The Contractor shall perform subsystem circuit stress analyses based on the available design and test data. These analyses shall identify any parts where individual part electrical/thermal stresses may approach or exceed the maximum levels allowed by SSDD high reliability derating criteria contained in STC-D-001. The Contractor shall also perform a detailed stress analysis on each part and prepare recommendations for resolving part applications where the high reliability derating criteria are exceeded.

6.1.1.3 Subsystem Reliability Models and Predictions

The Contractor shall prepare subsystem level reliability block diagrams and mathematical models to reflect the subsystem design baselines, mission success criteria and FMECA information. The Contractor shall modify reliability predictions through the application of functional subassembly failure rates and operating/nonoperating mission times in the mathematical models. The subsystem level reliability block diagrams and mathematical models shall be functionally and operationally compatible with appropriate system level reliability model to permit maximum integration and use of the subsystem level diagrams and math models in the system level reliability models.

6.1.1.4 Failure Rate Calculations

The Contractor shall derive subassembly failure rates employing MIL-HDBK-217 augmented by direct applicable test data, when available. The Contractor shall modify subassembly failure rates as necessary to reflect the results of both the applicable stress analysis and the applicable FMECA. The Contractor shall also derive subassembly operating/non-operating times to reflect mission operational time lines.

6.1.2 System Level Reliability Engineering

The Contractor shall generate, refine and maintain system block diagrams and mathematical models that reflect system level redundancy implementations, system success criteria and mission operating time lines. The Contractor shall conduct system level reliability analyses employing the system level reliability mathematical models and the subsystem reliability analysis results described in Section 6.1.1. System level reliability analyses shall include updated FMECA's with emphasis on single point failures to enable assessment of system

reliability and identification of further reliability improvements. The system level FMECA shall be performed in accordance with the requirements established in STC-D-001.

6.1.3 Maintainability and Availability Analyses

The Contractor shall conduct maintainability and availability analyses to project spacecraft replenishment rates, aerospace logistics support requirements and overall systems life cycle cost (LCC) characteristics in accordance with CDRL A014.

6.2 Design Verification Engineering

The Contractor shall have the demonstrated capability to and shall perform worst-case performance analyses on NRL electronic circuits to verify compliance with SSD-D-AS210B. The required analyses shall include, but may not be limited to, (a) transistor worst-case current gains analyses, (b) worst-case timing analyses, and (c) power converter worst-case analyses, as described below. Worst-case analyses shall be submitted in accordance with CDRL A007, Worst Case Analysis Reports.

6.2.1 Transistor Worst-Case Current Gains Analyses

The Contractor shall verify that each transistor application has sufficient gain margin under worst-case conditions. In addition, the Contractor shall modify the existing subsystem gain analyses as necessary to reflect changes incorporated in the unit or subsystem designs.

6.2.2 Worst-Case Timing Analyses

The Contractor shall perform worst-case timing analyses on digital circuits in accordance with CDRL A015. The Contractor shall identify and evaluate all instances of noncompliance with the criteria of SSD-D-AS210B for possible resolution. The Contractor shall provide recommendations for resolving any timing noncompliances to the COR**.**

6.2.3 Power Converter Worst-Case Analyses

The Contractor shall perform worst-case analyses of SSDD power converters to determine any instances of performance or stability characteristics which do not comply with the criteria of SSD-D-AS210B in accordance with CDRL A016. The Contractor shall identify all nonconformances in the analyses for resolution by the COR**.**

6.3 Quality Assurance Engineering

The Contractor shall support the production of NRL space and aerospace Software Definable/Reconfigurable System units and systems with a quality assurance program in compliance with SSDD requirements, including SSD-D-AS303, STC-D-001, SSD-D-AS214, and SSD-D-AS322. The Contractor shall provide Quality Assurance functions which shall include, but may not be limited to, (a) producibility and inspectability inputs to the design phase and inspections, (b) procedure monitoring, (c) nonconforming material controls, (d) calibration controls, and (e) test audits and implementation of corrective action throughout the fabrication, assembly and test of SSDD spacecraft and aerospace Software Definable/Reconfigurable System units and subsystems. The Contractor shall also participate in system level flight readiness reviews (FRR) and flight worthiness reviews (FWR) by providing QA inputs to the FRR/FWR data packages.

The Contractor shall provide QA engineering efforts in support of subsystem level development. This support shall include, but not be limited to, (a) performing QA engineering functions for the mechanical and electrical design engineering groups of the SSDD; (b) developing inspection flow plans to assist quality control inspection personnel; (c) reviewing contractor, subcontractor and vendor QA plans and procedures to determine compliance with SSDD requirements and participating in on-site surveys; (d) participating in system and subsystem design reviews; (e) assisting in the preparation of part specifications, drawings and source control drawings; (f) providing quality-related inputs to the Parts, Materials and Processes (PMP) group; (g) providing QA efforts in support of the fabrication and testing of subassemblies, assemblies and subsystems; and (h) participating in software peer reviews and inspections.

6.4 Parts Engineering

The Contractor shall have the demonstrated capability to and shall perform parts engineering efforts to assure that the appropriate SSDD parts selection control and testing requirements as delineated in STC-D-002, STC-D-009, STC-D-010, SSD-D-AS139 and SSD-D-AS214 are reflected in the subsystem designs and hardware produced for SSDD spacecraft and aerospace Software Definable/Reconfigurable systems. In addition, the Contractor shall test and evaluate parts to determine their performance and environmental application potential and limitations. The parts engineering tasks shall include, but not be limited to:

- Searching for parts designated for use by SSDD Programs to verify their adequacy for the SSDD application, including qualification status, availability, and radiation susceptibility;

- Identifying and evaluating potential substitute parts where the qualification listing and/or construction make contemplated parts questionable for SSDD applications;

- Developing recommendations for qualification and/or high reliability processing programs where SSDD requirements indicate the need for reliability verification and/or improvement via screening and test;

- Generating part Specification Control Drawings (SCD's) to control critical part parameters or to invoke special part processing and/or testing requirements;

- Performing vendor surveys and evaluating critical part manufacturers to ascertain their capability to provide parts consistent with SSDD reliability, performance and schedule requirements;

- Evaluating specific parts based on an analytical study of the construction of the devices using state-of-the-art dissection techniques, microphotography, Scanning Electron Microscopy (SEM) and Energy Dispersive Spectroscopy (EDS) and preparing formal reports of conclusions and recommendations upon completion;

- Interfacing with part vendors/manufacturers that require assistance in implementing SSDD requirements on process controls, manufacturing and test environments, and screening or qualification testing. Research, evaluation, selection, review and analyses results shall be presented as formal reports on each subject part;

- Generating Nonstandard Part Approval Requests (NSPARs) for those parts which cannot be identified as SSDD approved;

- Generating Candidate Parts Lists (CPLs) and documenting the results of subsystem/unit parts list reviews;

- Maintaining the Qualified Parts List (QPL), SSD-D-AS139;

- Maintaining the Parts Program Requirements and Guidelines document, SSD-D-AS214;

- Evaluating the characteristics of the operational radiation environment and recommending modifications to the specified hardness environment;

- Maintaining communications with the national radiation test network to obtain current information of tests and manufacturers process or technology revisions; and

- Conduct total dose radiation tests and Single Event Upset (SEU) susceptibility tests.

6.5 Materials and Processing Engineering

The Contractor shall have the demonstrated capability to and shall review specific materials and processes contemplated for use by NRL. The Contractor shall evaluate materials for their suitability for use in the environment and for their intended application to determine any potential development constraints relating to toxicity, flammability and high vacuum atmospheric environment, specifically for minimization of Collected Volatile Condensable Materials (CVCM) and Total Mass Loss (TML).

The Contractor shall conduct detailed material property analyses and process development efforts. Material property analyses shall define the applicability of the material in question for use of SSDD programs and, if necessary, determine and recommend acceptable substitutions.

Process development efforts shall include evaluation of production techniques, process controls, handling procedures, and state-of-the-art applications for the control of part, assembly or system reliability. The Contractor shall document the results of material evaluations and process engineering efforts in formal reports which define the results and recommendations.

6.6 Failure Analysis

The Contractor shall have the demonstrated capability to and shall perform failure analyses on parts, subassembly units and subsystems which are identified by NRL. Failure analyses shall be conducted to the extent necessary to determine the most probable cause(s) of failure, which may include analyses ranging from a simple witnessing or deduction of the cause of failure to a comprehensive analysis of the failed hardware. The Contractor shall determine the appropriate failure analysis approach using such evaluation techniques as (a) radiographic examination, (b) micro probing, (c) dissection, (d) cross sectioning, (e) decapsulation, (f) SEM, (g) plasma etching, (h) EDS, or other tests as necessary to isolate the failure mechanism. The Contractor shall document the comprehensive failure analyses in formal failure analysis reports, the results of which shall be submitted in accordance with CDRL A008, Failure Analysis Reports.

The Contractor shall evaluate failures, troubles and/or malfunctions that are directly related to the design and test program. The purpose of this requirement is to assure that all failures observed are reported, evaluated from the reliability and operational viewpoints, analyzed, and then acted upon. The Contractor shall also evaluate design changes which may prevent recurrence of the failure mode and, therefore, improve system reliability.

The Contractor shall provide the results of failure analysis engineering efforts to NRL for processing through the SSDD Failure Reporting and Corrective Action (FRACA) system to facilitate closeout of the corrective action.

6.7 Integrated Logistics Support (ILS)

The Contractor shall have the demonstrated capability to and shall apply analytical techniques directed toward ensuring cost effective support of equipment and systems, (including the equipment/system support environment and resources) for their entire life cycle. The Contractors primary goals under this subtask shall be (a) to influence the system/equipment design process by development of design for supportability requirements, evaluating the consequences of design decisions and proactive participation in the design and design review process, or products; (b) to develop a support plan which allows achievement of specified supportability and operational objectives over the life cycle of the system/equipment; (c) to implement the support plan, and (d) to monitor the effectiveness and appropriateness of the support plan once implemented.

The work to be performed under this subtask shall include, but may not be limited to: (a) ILS planning; (b) Logistics Support Analysis; (c) Life Cycle Cost Analysis; (d) Reliability design,

evaluation and monitoring; (e) Maintainability design, evaluation and monitoring; (f) maintenance and maintenance planning; (g) design and development of technical data, manuals and handbooks; (h) design and development of training and training documentation/material; (i) identification of skills and manpower requirements, prerequisites and sources; (j) identify requirements and resources to satisfy packaging, handling, storage and transportation needs; (k) identify, quantify, locate, purchase and replenish spare and repair parts; (l) minimize need for, identify, purchase and replenish support and test equipment; (m) identify requirements, analyze existing, and define requirements for new facilities; and (n) identify, examine and make recommendations concerning computer based systems for diagnostics, training, and on-line documentation.

Analyses and reports generated as deliverable under this subtask shall be submitted in accordance with CDRL A009, Integrated Logistics Support Data.

6.8 Facility Systems Effectiveness Support

The Contractor shall have the demonstrated capability to and shall study, evaluate, recommend and implement improvements to enhance productivity and quality of the development work being performed in the NRL fabrication, design and test facilities.

7.0 PARTS PROCUREMENT AND PROCESSING

The Contractor shall have the demonstrated capability to and shall procure and process parts to the NRL and NASA requirements for space systems. This tasking shall include, but not be limited to the procurement planning, procurement and processing (i.e., expediting, internal control, screening, qualification and destructive physical analysis (DPA)). The Contractor shall have the capability to process at least 2,000 lots of parts totaling at least 100,000 parts annually. The Contractors purchasing system shall have been and shall be approved by DCMA.

All space systems parts shall be selected, procured, screened and qualified to the requirements of NRL STC-D-002, Naval Center For Space Technology (NCST) Parts Program Requirements and Guidelines, and NASA EEE-INST-002, Instructions for EEE Parts Selection, Screening Qualification and Derating unless otherwise directed by the COR. The parts screening and DPA facilities and equipment employed in the screening and DPA effort accomplished on space parts shall be owned and operated by the Contractor using Contractor employees to assure that the parts processing tasking is well controlled for maximum reliability. Parts processing data shall be submitted under CDRL Item A010, Test and Analysis Reports.

7.1 Parts Screening

Space system parts, including but not limited to microcircuits, RF amplifiers, active discrete semiconductors (e.g., transistors, diodes), FPGA’s, hybrid devices, filters, oscillators, relays and

passive devices (e.g., capacitors, resistors, magnetic devices) shall be screened under this subtask. The parts screening shall include, but not be limited to performance testing, particle impact noise detection (PIND) testing, real time radiographic inspection with digital output of images, power burn-in, high temperature reverse bias (HTRB) burn-in, fine and gross leak testing, power/voltage conditioning, constant acceleration, temperature cycling/ thermal shock testing and humidity testing in accordance with SDD-D-002, SDD-D-AS214 and NASA EEE-INST-002.

Chip tantalum capacitors shall be subjected to surge current testing in accordance with the requirements of MIL-PRF-55365, Capacitor, Fixed, Electrolytic (Tantalum), Chip, Non-established Reliability, Established Reliability, General Specification For, as imposed by surge current Option A of the specification. Leaded tantalum capacitors shall be subjected to surge current testing in accordance with MIL-PRF-39003/9, Capacitor, Fixed, Electrolytic (Solid Electrolyte) Tantalum, (Polarized Sintered Slug), High Frequency, Established Reliability Styles CSR21. Samples from each lot of ceramic capacitors rated below 100V shall be subjected to Humidity Steady State Low Voltage testing (85°C and 85% relative humidity) in accordance with MIL-PRF-123, Capacitors, Fixed, Ceramic Dielectric (Temperature Stable and General Purpose), High Reliability, General Specification for (5 piece sample for each lot/date code).

Custom magnetic devices (transformers and inductors) shall be assembled and screened to the requirements of MIL-STD-981, Design, Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Applications.

7.2 Destructive Physical Analysis

A sample of each lot date code of microcircuits, hybrid microcircuits, EMI filters, relays, capacitors, oscillators, and semiconductor devices destined for use in NRL space systems shall be subjected to a Destructive Physical Analysis (DPA) unless otherwise directed by the COR. Other parts may require a sample DPA if it is deemed necessary by the COR

DPA tests, procedures, sample size and criteria will be as specified in NRL SSD-D-009C, Destructive Physical Analysis Procedure, and GSFC specification S-311-M-70. The DPA process shall include, but not be limited to, visual micro-inspection, scanning electron microscope (SEM) inspection of die bonds, step coverage, registration, and contamination, quantitative material composition analysis using SEM and energy dispersive X-ray micro-analysis, bond pull testing, die sheer testing and non-cavity device cross-sectioning, lapping and inspection.

8.0 FABRICATION ACTIVITIES

The Contractor shall perform material acquisition and control, fabrication and assembly of units for the various SSDD spacecraft and aerospace Software Definable/Reconfigurable systems. Manufacturing data shall be provided for NRL review at the unit, subsystem and/or system Physical Configuration Audit (PCA) Review in accordance with CDRL A017.

8.1 Material Acquisition and Control

The Contractor shall acquire the specialized material, hardware, printed wiring boards, fabricated items and chassis for use in fabricating space and aerospace Software Definable/Reconfigurable System units and systems. These items shall be procured to controlled drawings and/or specification control documents (SCD's) developed by the Contractor. The Contractor shall inspect, test and document that the materials conform with approved standards; and shall maintain these records so that specific parts electrical test performance can be recalled for future evaluation. The Contractor's purchasing system shall be one that has been and is currently approved by DCMA.

The Contractor shall maintain accepted material in segregated and controlled stores with traceability to the acquisition records, the design revision level and the inspection results. The Contractor shall also provide kitting and other material control functions including packaging and shipment of individual material items and/or material lots requested by the COR. Kitting shall also be accomplished in conformance with SSDD forward-traceability requirements as specified by SSD-D-AS214, SSD-D-AS303 and other applicable program requirements.

8.2 Fabrication and Assembly

The Contractor shall perform manufacturing operations necessary for production of NRL space and aerospace Software Definable/Reconfigurable System units and systems. The Contractor shall have the in-house equipment, facilities, employees and proven processes in place and fully qualified and certified to fabricate, assemble and inspect space and aerospace Software Definable/Reconfigurable System electronics on a quick turnaround basis. This shall include, but not be limited to automated pick-and-place, surface mount technology (SMT) assembly, ball grid array (BGA) assembly and column grid array (CGA) assembly. The Contractor's column grid array (CGA) assembly process shall have been formally qualified for use in the low Earth orbit (LEO) space environment.

The Contractor shall have real time radiographic inspection capabilities for the inspection of parts, printed wiring boards (PWB's) and completed assemblies. The Contractor shall also have the equipment, personnel and processes, and clean room facilities (controlled to 10,000 particles per cubic foot) qualified for the assembly of optics and other contamination sensitive technology systems and assemblies, and trained personnel certified to instruct and assemble to NASA-STD-8739-1, Workmanship Standard For Staking And Conformal Coating Of Wiring Boards And Electronics Assemblies, NASA-STD-8739.2, Workmanship Standard For Surface Mount Technology, NASA-STD-8739.3, Soldered Electrical Connections, and NASA-STD-8739.4, Crimping, Interconnection Cables, Harnesses and Wiring. The Contractor manufacturing process shall be in compliance with SSD-D-AS139, Qualified Parts List; and product assurance/quality assurance documents including STC-D-0001, and SSD-D-AS303. All manufacturing processes shall be fully documented and formally controlled to assure consistent results.

9.0 TEST AND VERIFICATION

The Contractor shall develop, conduct and/or monitor test and verification programs on space and Software Definable/Reconfigurable systems developed by the Contractor and by others as directed by the COR. These test and verification programs shall include, but not be limited to development testing (DT), Design Verification Testing (DVT), Qualification Testing, and Acceptance Testing at the part, software, hardware module, subassembly, unit and system levels, and field testing, including Limited User Evaluations (LUE's). The Contractor shall design these test and verification programs to verify achievement of those requirements designated for verification by test and to demonstrate sufficient margins in critical design parameters. Test reports shall be submitted under CDRL Item A010.

The Contractor shall have the facilities, equipment and trained employees to and shall conduct powered thermal vacuum cycling at a vacuum of 1×10^{-6} Torr and over temperature extremes ranging from - 40 to + 85 degrees centigrade; to conduct this testing on four units simultaneously at four different temperature levels, and a single unit with dimensions of 45 inches by 15 inches by 15 inches with the baseplate surface of 45 inches by 15 inches.